Cellulose Esters.

Technology of Cellulose Esters. (In Ten Volumes.) By E. C. Worden. Vol. 1, part 1, *Cellulose, Starch, Cotton.* Pp. cxxv + 664. Part 2, *Nitric, Sulfuric, Mixed Acids.* Pp. cxvii + 665–1566. Part 3, *Nitrocellulose: Theory, Practice.* Pp. cxvii + 1567–2376. Part 4, *Historical Development.* Pp. cxvii + 2377–3086A. Part 5, *Index.* Pp. 3087–3709. (London: E. and F. N. Spon, Ltd., 1921.) 10*l.* 10*s.* net (five parts).

THE child whose first sight of a giraffe called forth the ejaculation, "I don't believe it," represents the reviewer ruminating on the first impression produced by this work, vol. 1, in five parts—literally five robust volumes—representing 18½ lb. of actual weight, and presumably 10*l.* 10*s.* of value as claimed. The impression is deepened by the author's "Announcement and Preface," which sets forth his aim and constructive conception of the work, the present volume, and the nine to follow! The incidental statistics will make a strong appeal to the mere megalophile. The preparation of the data has involved 365,000 index-cards; the matter deals with the work of 55,000 investigators, involving 350,000 references to technical-scientific literature. These figures should produce a moral impression on the external world—external, that is, to the "world" of cellulose, of which the author will be acclaimed as histriographer-, if not cartographer-, in-chief.

To the world at large and the English-speaking world in particular, "cellulose" has been little more than a name, and "ester" a specimen of a barbarous terminology quite remote from the "things that matter." Nevertheless, cellulose esters were a dominating factor of the great war and "cellulose" connotes many of the primary necessities and joys of daily life.

It is evidently impossible in a review to convey, even to the trained mind of the critical student, any adequate digest of the contents of a work of really colossal range. The attempt, moreover, would be gratuitous, for its character is that of an encyclopædia. It has not the aim of a text-book, and although the author claims that "its statements are aimed at the intelligence of a sympathetic human being," we cannot take this point of view in commending the book, for the emotions are not touched by technical records and statistics, and it requires a sympathetic temperament of an unusual order to draw inspiration from a museum.

We have prepared the reader for a really spontaneous tribute to the author in achieving a work which has involved twenty-five years of labour. The present result, only an instalment, is evidence of such long-sustained perseverance, of great ability, of courage, and all the qualities associated with moral enthusiasm. With the experience of a still longer connection with the subject-matter, we have tested vol. 1 in regard to selected typical "topics"—to use a favourite term of the author's—and find the information exhaustive, accurate, and, by reason of sound method in indexing, readily accessible.

It should be noted in regard to the plan of the work that chaps. 1–3, constituting sectional vol. (part) 1, of 664 pages, deal with "Cellulose," "Starch," and Cotton," and together form a generalised foundation for the main subject. The treatment follows no general systematic order, though the sections are in many cases an *exposé* in logical sequence, as, for example, the section on "Cellulose Analysis," contributed by J. F. Briggs.

It is clear that the work was not planned *ab initio*, but has grown as a compilation and an agglomerate; the author has continued his compilation, and the accretions of contributors and collaborators have been selected and incorporated from time to time. Thus the work has evolved as a compilation, an agglomerate and also conglomerate: for science and technology, abstractions and utilities, the essential and the trivial are put together, without apparent method, *i.e.* without subordination to the perspective of first principles.

This does not detract from the great value of the work to the already instructed, the specialist, whether of science or technology, seeking to inform himself on the records of research or technical development to date. Such readers of critical habit will methodise the matter in reading, whereas the general reader or student of science or technology would rapidly reach discouragement and mental indigestion.

As a work to be recognised as a standard book of reference it is only right to examine it as a literary production. The author's mentality, to use his own word, and style are revealed in a prolix "Announcement and Preface," occupying six closely printed pages. Opposite the first page, on an otherwise blank sheet, the author has printed a three-line exordium:—

"Work for the night
is coming, when
Man's work is done."

The punctuation being as reproduced, and the middle line in prominent type, the effect of the paraphrase is confusion and shock. We remember

© 1921 Nature Publishing Group

a verse in the "Paraphrases" of the U.P. Church:

"The Lord will come and He will not
Keep silence but speak out,"

which, declaimed line by line, produced a similar effect. Early in the preface proper we have the sentence: "Be it monumental, or otherwise, every effort of attempted merit has a definite aim." The author is thinking big things, and perhaps with clear meaning to himself, but his words merely paralyse the reader. The paragraph goes on to reveal the author's central purpose:—

"The aim of the work is to present the entire subject of the combinations of normal and modified celluloses, with acidyl and alkyl radicals, in such completeness, clarity, accuracy, and detail, that inability to locate the information desired in the collective index will be positive evidence that the matter sought was either ephemeral, irrelevant, inaccurate, non-existent, or valueless!"

It would have been easy to have said: "The work is devised as a comprehensive and exhaustive account of the cellulose esters, subserving constructive science, and with critical exclusion of the ephemeral and valueless. It is claimed for the collective index that it is final as a record of such critical selection." This is probably the expression of the author's claim, whereas he leaves the reader to conclude that the main value of the work is its collective index, and that his chief function has been the winnowing out of the chaff and even the non-existent. This is one of many cases where the author's meaning requires to be interpreted considerably and considerately.

Such curious evaluation of words and language is especially characteristic of the handling of the central subject of nitrocellulose. Thus the important chap. 9 is headed "Nitrocellulose Theory." The author's method, however, is that of recording in chronological sequence the investigations which brought the cellulose nitrates into existence and gradually into use. In a single paragraph forecast there are no indications of theory, and the chapter proceeds through 120 pages of records before arriving at a section headed "Theory of Nitration," upon which he says: "The entire theory and practice of the esterification of the carbohydrates rests at the present time upon an empirical basis and upon a series of assumptions and predictions . . ." a statement which is seriously incorrect. After setting out what he regards as the difficulties in the way of generalisation or theory, he comes to the conclusion, expressed in rhetorical form as follows:—

"It must be obvious to the unbiased, non-speculative, reflective mind conversant with this subject and cognizant of the difficulties embraced therein, that the sum total of contributions of those who have lived and worked and gave, constitute but the denting or etching of the periphery of a vast sphere whose potentialities are practically limitless. Such, at least, are the views of the author."

The form of words and incidental grammar are the author's own. Without emphasising their eccentricity, we suggest that he uses rhetoric as a cloak for the abdication at a critical moment of his true *rôle* as constructive chronicler. The facts are that empiricism has marked most of the stages of evolution of what the author would know as "the art," but there have been definite phases of progress in theory. If the matter had been handled on a definite plan of "theory," as the heading of the chapter would lead one to expect, the records would have been edited in such a way as to follow and forecast progress, and to be a useful guide, not only to research, but also to consequent practical developments. On the subject of "Stability," which involves a leading point in the theory of these esters, viz. the reactions of formation and decomposition, the author avoids his responsibility of setting out the very definite phases of advance, and the reviewer has had to dig out for himself the connected story of this important section. It is only right to say that the records are full, and anyone having general knowledge of the subject can supply the deficiency.

In regard to these volumes as books, the author properly directs attention to the printing of the matter, which is certainly an achievement. The paper he describes as "Olde style," which appears to mean an ultra-modern paper of wood cellulose with from 15 to 20 per cent. loading, and calendered to about one gram per c.c., and weighing 110 grams per sq.m. of surface. This accounts for the excessive weight of the volumes. Moreover, in each volume, *except* the index volume, there is reproduced the author's list of abbreviations of the technical journals quoted—about ninety-two pages! This is an unnecessary addition to weight; there should have been one such list included in the index volume.

We have endeavoured in this inadequate notice to give such an account of the work as will help to secure its proper reception by the technical-scientific public. It is undoubtedly "monumental," and has the greatest possible merit as a record. It is obviously an indispensable addition to the library of all who have a special connection with the subject.

© 1921 Nature Publishing Group